THE UNIVERSITY OF CHICAGO
DEPARTMENT OF THE GEOPHYSICAL SCIENCES

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METEOROLOGICAL INTERPRETATION OF SATELLITE RADIATION DATA

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SEMIANNUAL REPORT

During the report period the following investigations were performed:

1. Angular Dependence of Backscattered Radiation over the Sahara Areas.

This study has been completed and the results are described in SMRP Research Paper No. 73.

2. Yaw Correction for Accurate Gridding of Nimbus HRIR Data.

This research was not completed before Mr. Roland Madden went to NCAR at Boulder, Colorado. The report will be rewritten and completed by the end of the summer of 1968.

3. Evaluation of HRIR and MRIR Data from Nimbus II Orbits over the Far East.

Progress is continuing on this research. Mr. Kantaro Watanabe is completing the work and writing the results at Kobe Observatory. It is expected that this report will be issued by the end of summer 1968.

4. Aerial Measurement of Radiation Temperatures over Mt. Fuji and Tokyo Areas and their Application to the Determination of Ground- and Water-Surface Temperatures.

A Barnes PRT-4 portable radiometer with a spectral response in the 8-14 micron range was used to determine the equivalent blackbody temperature of (1) the slope of Mt. Fuji, (2) Sagami Bay, and (3) the city of Tokyo. A twin-engine aircraft was used to fly over these areas at various altitudes up to 12,000 ft. Through mapping the slope temperatures of Mt. Fuji, it was learned that the rocky slope heats up under the morning sun very rapidly to 32C almost irrespective of the elevation. The distribution of measured temperatures explains the reasons for the rapid growth of cumulus clouds along the east slope in the early morning hours. The nadir-angle and the height dependence of equivalent blackbody temperatures measured over Tokyo and Sagami Bay was examined. The measured temperatures were compared with those computed from the radiative transfer equation. It was found that the values over Tokyo are reproduced fairly well by the addition of a graybody smog filling the layers up to 910 mb. To express the effects of atmospheric radiation upon the reduction of the radiant emittance from the surface, a damping factor was introduced. The factor which designates the reduction of the amplitude of the surface temperature when measured from aircraft or satellites must be known to an accuracy of about 10% in order to estimate the true temperature variation or gradient from measured equivalent blackbody temperatures. Further investigation of

the temperature damping is necessary to determine accurately the radiometric sea-surface temperature.

The results have been described in SMRP Research Paper No. 72 issued in March 1968. It has also been submitted for publication in the Journal of Applied Meteorology and will appear in the October 1968 issue.

5. Evaluation of Interpretation of ATS Pictures.

Several time-lapse movie films have been made using ATS I and III picture sequences to study cloud motions at different levels, development of mesoscale systems, and cloud distribution over vast ocean areas. The films produced during this report period were:

a. "First color movie of the earth from the ATS III satellite."

This film was first presented by Prof. V. Suomi at the 48th Annual Meeting of the American Meteorological Society at San Francisco on December 29, 1967. Since then numerous copies of the film have been distributed both nationally and internationally.

b. "The Severe Storm Situation of 11 March 1968."

Using the ATS III picture sequence for 11 March 1968 a time-lapse movie was made showing a severe storm situation. This was a test case to determine the feasibility of using this technique for improving tornado situation forecasts. As a result of the evaluation NASA decided to conduct a tornado watch experiment during April and part of May. Three principal experimenters, Prof. Suomi of the University of Wisconsin, Mr. V. Oliver of ESSA, and Prof. Fujita of the University of Chicago were assigned.

c. "Clouds over Hawaii."

This film was presented at the Fifth Technical Conference on Hurricanes and Tropical Meteorology in November 1967 at Caracas, Venezuela. Cloud motion computations were made from the ATS I picture sequences and these motions were compared with those determined from ground-based camera systems.

c. "Tropical Cyclones."

The life history of Typhoon Sarah which developed off the California Coast in early September 1967 and moved across the entire Pacific to Japan was depicted in a time-lapse movie made from ATS I picture sequences. Also included in this film were two other typhoon situations which showed the motions of the storms, one over the south Pacific and the other over the eastern mid-Pacific.

It is planned to improve the technique of presenting the ATS picture sequences in time-lapse movie form covering the tornado season and then the hurricane season of 1968.